1860MNRAS..20..296N

that is $[\cos + \sin]^i$ stands for $[\cos]^i + [\sin]^i$, and similarly $[\cos - \sin]^i$ for $[\cos]^i - [\sin]^i$; and it is clear that we have

$$[\cos + \sin]^{-i} = [\cos - \sin]^i, \quad [\cos \pm \sin]^0 = [\cos]^0.$$

These coefficients $[\cos \pm \sin]^i$ are for many purposes equally useful with the coefficients $[\cos]^i$, $[\sin]^i$, and they are here tabulated accordingly.

The functions calculated are as follows:—

$$\left(x^1,\ x^2\ .\ .\ .\ .\ .\ x^7\right) \qquad , [\cos];$$

$$\left(x^0,\ x^1,\ x^2\ .\ .\ .\ x^7\right)\genfrac{}{}{0pt}{}{\cos}{\sin} jf, \qquad j=1 \text{ to } j=7, [\cos], [\sin], [\cos \pm \sin];$$

$$\left(\left(\frac{r}{a}\right)^{+4}, \ldots \left(\frac{r}{a}\right)^{+1}, \log\frac{r}{a}, \left(\frac{r}{a}\right)^{-1} \ldots \left(\frac{r}{a}\right)^{-5}\right) \qquad , [\cos];$$

$$\left(\left(\frac{r}{a}\right)^{+4} .\ .\ \left(\frac{r}{a}\right)^{+1}, \quad \left(\frac{r}{a}\right)^{-1} \ldots \left(\frac{r}{a}\right)^{-5}\right)\genfrac{}{}{0pt}{}{\cos}{\sin} jf, j=1 \text{ to } j=5, [\cos], [\sin], [\cos \pm \sin].$$

all the developments being carried up to $e^7$, the limit of the formulæ from which they are deduced.

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## *Observation of the Occultation of Jupiter by the Moon, on May* 24, 1860. By Capt. W. Noble.

The brilliancy of the sunlight, and the disturbance of the atmosphere, necessitated the employment of a low power, to obtain a sharp and distinct view of the planet; I accordingly observed with a power of 42. I cannot speak with any great decision as to the instant of first contact, but it was perceptible to me at $8^{\rm h}\ 45^{\rm m}\ 32^{\rm s}$ L.S.T.; the final disappearance took place at $8^{\rm h}\ 46^{\rm m}\ 32^{\rm s}{\cdot}3$ L.S.T.

The first indication of the emergence of the planet was visible

at $9^{\rm h}\ 57^{\rm m}\ 34^{\rm s}$ L.S.T., and its complete emersion took place
at $9\ \ 58\ \ 33$ L.S.T.

When *Jupiter* had reappeared to the extent of about two-thirds of his area I received the impression for several seconds of a dark shadow or line bounding the moon's limb where it crossed

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the planet, as described at pp. 70, 76, 77, and 80, of vol. xvii. of the *Monthly Notices*, by Messrs. Lassell, Mann, Dawes, Simms, &c. &c. It is a somewhat anomalous fact that I witnessed this same phenomenon during the occultation of *Mars* by the moon on 13th October, 1857; while, on the occasion of the occultation of *Saturn*, on the 8th of May last year, nothing whatever of the sort was visible (*Monthly Notices*, vol. xviii. p. 27, and vol. xix. p. 242). The moon and *Jupiter* were so apparently equal in brightness for a few seconds after the planet began to emerge, that he looked like a distorted portion of the lunar limb; as, however, the moon passed gradually off his disk he became sensibly paler; and when he was fairly clear of our satellite, his light was noticeably fainter than hers, his two principal belts were well seen throughout.

The telescope employed was my Ross equatoreal of 4·2 inches aperture and 61 inches focal length, with a power (as stated above) of 42, adjusted on *Jupiter*.

*Forest Lodge, Maresfield, Sussex, May* 29, 1860.

## *On Projection in Lunar Occultations.*

### By the Rev. T. W. Webb.

The attention of astronomers having recently been directed to the phenomenon of projection on the lunar disk at the time of occultations, I beg to point out an instance, which, as far as I know, has not been alluded to; where this strange anomaly seems to have been perceived by the unassisted eye. The date of this occurrence was 1794, March 7, and it is described at length in the *Philosophical Transactions* for that year. I have not at present access to the volume, but from an abstract in my possession it appears that three persons at Norwich, and one in London, saw a star that evening in the dark part of the moon, which had not then attained the first quadrature; and from the two representations which are given, the star must have appeared very far advanced upon the disk. On the same evening there was an occultation of *Aldebaran*, which Dr. Maskelyne thought a singular coincidence, but which would now be acknowledged as the cause of the phenomenon.

In the *Cométographie* of Pingré, tom. i. p. 321, is the following passage. [A.D.] "547. Une étoile entra sur le disque de la lune. Quelques écrivains rapportent ce phénomène à l'an 553; d'autres le font arriver entre 547 et 549." The references are to Aimoinus, the chronicles of St. Denys, Gregory of Tours, and Toromachus. This looks like a similar occurrence to the one just mentioned; but in the uncertainty of the date it would be a fruitless task to endeavour to ascertain

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